

WHAT IS CLAIMED IS:

1. A silica fine particle which has been hydrophobic treated, and has a peak in a particle diameter range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  and a peak in the particle diameter range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in a volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter,

wherein the silica fine particle has a frequency ratio of 10 to 80% for the particles with a particle diameter in the range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  to a total of all the peaks, and has the frequency ratio of less than 16% for the particles with the particle diameter of 20  $\mu\text{m}$  or more and less than 2000  $\mu\text{m}$  to the total of all the peaks, respected to the volume-basis particle diameter distribution.

2. The silica fine particle according to claim 1, wherein the silica fine particle has the frequency ratio of 20 to 70% for the particles with the particle diameter in the range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  to the total of all the peaks, and have the frequency ratio of less than 12% for the particles with the particle diameter in the range of 20  $\mu\text{m}$  or more and less than 2000  $\mu\text{m}$  to the total of all the peaks, respect to the volume-basis particle diameter

distribution measured by using the laser diffraction particle diameter distribution meter.

3. The silica fine particle according to claim 1, wherein a half-value width of a maximum peak present in a range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in particle diameter is 5 to 25  $\mu\text{m}$  with respect to the volume-basis particle diameter distribution measured by using the laser diffraction particle diameter distribution meter.

4. The silica fine particle according to claim 1, wherein a half-value width of a maximum peak present in a range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in particle diameter is 8 to 20  $\mu\text{m}$  with respect to the volume-basis particle diameter distribution measured by using the laser diffraction particle diameter distribution meter.

5. The silica fine particle according to claim 1, wherein a volume average particle diameter is 0.1 to 20  $\mu\text{m}$  with respect to the volume-basis particle diameter distribution measured by using the laser diffraction particle diameter distribution meter.

6. The silica fine particle according to claim 1, wherein a volume average particle diameter is 0.3 to 12

μm with respect to the volume-basis particle diameter distribution measured by using the laser diffraction particle diameter distribution meter.

7. The silica fine particle according to claim 1, wherein a BET specific surface area is in a range of 30 m<sup>2</sup>/g or more and less than 100 m<sup>2</sup>/g.

8. The silica fine particle according to claim 1, which comprising composite particle formed by combining a plurality of primary particles.

9. The silica fine particle according to claim 1, wherein the silica fine particle is hydrophobic treated with a silane coupling agent and/or silicone oil.

10. The silica fine particle according to claim 1, wherein the silica fine particle is obtained by treating a silica fine particle with a silane coupling agent and silicone oil and then subjecting the silica fine particle to classify and/or crush.

11. The silica fine particle according to claim 1, wherein the silica fine particle is treated with silicone oil, and an addition amount of the silicone oil is 3 to 35 parts by mass with respect to 100 parts by mass of silica fine particles before the treatment.

12. The silica fine particle according to claim 1, wherein the silica fine particle is treated with silicone oil, and an addition amount of the silicone oil is 5 to 25 parts by mass with respect to 100 parts by mass of silica particles before the treatment.

13. A toner comprising a toner particle and an external additive, wherein:

the toner particle has a weight average particle diameter of 4 to 9  $\mu\text{m}$ ; and

the external additive contains at least a silica fine particle (A) which has been hydrophobic treated, and has a peak in a particle diameter range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  and a peak in the range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in a volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter,

the silica fine particle (A) has a frequency ratio of 10 to 80% for the particles with a particle diameter in the range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  to a total of all the peaks, and has the frequency ratio of less than 16% for the particles with the particle diameter of 20  $\mu\text{m}$  or more and less than 2000  $\mu\text{m}$  to the total of all the peaks, respected to the volume-basis particle diameter distribution.

14. The toner according to claim 13, wherein the

silica fine particle (A) has the frequency ratio of 20 to 70% for the particles with the particle diameter in the range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  to the total of all the peaks and has the frequency ratio of less than 12% for the particles with the particle diameter of 20  $\mu\text{m}$  or more and less than 2000  $\mu\text{m}$  to the total of all the peaks, respected to the volume-basis particle diameter distribution measured by using the laser diffraction particle diameter distribution meter.

15. The toner according to claim 13, wherein the silica fine particle (A) has a half-value width of a maximum peak present in a range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in particle diameter of 5 to 25  $\mu\text{m}$  with respect to the volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter.

16. The toner according to claim 13, wherein the silica fine particle (A) has a half-value width of a maximum peak present in a range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in particle diameter of 8 to 20  $\mu\text{m}$  with respect to the volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter.

17. The toner according to claim 13, wherein the

silica fine particle (A) has a volume average particle diameter of 0.1 to 20  $\mu\text{m}$  with respect to the volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter.

18. The toner according to claim 13, wherein the silica fine particle (A) has a volume average particle diameter of 0.3 to 12  $\mu\text{m}$  with respect to the volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter.

19. The toner according to claim 13, wherein the silica fine particle (A) has a BET specific surface area in a range of 30  $\text{m}^2/\text{g}$  or more and less than 100  $\text{m}^2/\text{g}$ .

20. The toner according to claim 13, wherein the silica fine particle (A) comprises a composite particle formed by combining a plurality of primary particles.

21. The toner according to claim 13, wherein the silica fine particle (A) has been hydrophobic treated with a silane coupling agent and/or silicone oil.

22. The toner according to claim 13, wherein the

silica fine particle (A) is obtained by treating silica fine particle with a silane coupling agent and silicone oil and then subjecting the silica fine particle to classification and/or crush.

23. The toner according to claim 13, wherein the silica fine particle (A) is treated with silicone oil, and an addition amount of the silicone oil is 3 to 35 parts by mass with respect to 100 parts by mass of silica fine particles before the treatment.

24. The toner according to claim 13, wherein the silica fine particle (A) is treated with silicone oil, and an addition amount of the silicone oil is 5 to 25 parts by mass with respect to 100 parts by mass of silica fine particles before the treatment.

25. The toner according to claim 13, further comprising at least one kind of a fine particle (B) having an average length of primary particles, which is smaller than that of the silica fine particle (A).

26. The toner according to claim 25, wherein the fine particle (B) has a BET specific surface area in a range of 100 m<sup>2</sup>/g or more and less than 200 m<sup>2</sup>/g.

27. The toner according to claim 25, wherein the

fine particle (B) has a number average length of the primary particles in the range of 1 to 50 nm.

28. A toner according to claim 25, wherein the fine particle (B) is selected from the group consisting of an alumina fine particle, a titanium oxide fine particle, a zirconium oxide fine particle, a magnesium oxide fine particle, a silica fine particle, and a composite fine particle thereof.

29. A toner according to claim 25, wherein the fine particle (B) is a silica fine particle treated with at least silicone oil or a titanium oxide fine particle treated with a silane coupling agent.

30. A toner according to claim 13, wherein 0.05 to 1.0 part by mass of the silica fine particle (A) is contained with respect to 100 parts by mass of toner particles.

31. A toner according to claim 25, wherein 0.1 to 2.0 parts by mass of the fine particle (B) is contained with respect to 100 parts by mass of toner particles.

32. A toner according to claim 13, wherein the toner is a non-magnetic toner.



33. A toner according to claim 13, wherein the toner particle has an average circularity of 0.950 to 0.995, which is measured using a flow type particle image analyzer.

34. A toner according to claim 13, wherein the toner particle has an average circularity of 0.960 to 0.995, which can be measured using a flow type particle image analyzer.

35. A toner according to claim 13, wherein the toner particle is produced in an aqueous medium.

36. A toner according to claim 13, wherein the toner particle is manufactured by polymerizing a polymerizable monomer composition that comprises at least a polymerizable monomer and a colorant in a solvent in the presence of a polymerization initiator.

37. A two-component developer comprising a carrier and a toner having at least a toner particle and an external additive, wherein:

the toner particle has a weight average particle diameter of 4 to 9  $\mu\text{m}$ ;

the external additive contains at least a silica fine particle (A) which has been hydrophobic treated, and has a peak in a particle diameter range of 0.04  $\mu\text{m}$

or more and less than 1  $\mu\text{m}$  and a peak in the particle diameter range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in a volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter,

the silica fine particle (A) has a frequency ratio of 10 to 80% for the particles with a particle diameter in the range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  to a total of all the peaks, and has the frequency ratio of less than 16% for the particles with the particle diameter of 20  $\mu\text{m}$  or more and less than 2000  $\mu\text{m}$  to the total of all the peaks, respected to the volume-basis particle diameter distribution; and

the carrier has a 50% particle diameter of 15 to 60  $\mu\text{m}$  on the basis of volume, and a shape factor SF-1 of 100 to 130.

38. The two-component developer according to claim 37, wherein the carrier comprises 5% by volume or less of particles each having the particle diameter that corresponds to 2/3 or less of the 50% particle diameter.

39. The two-component developer according to claim 37, wherein the carrier has a resistivity of  $1 \times 10^8$  to  $1 \times 10^{16} \Omega \cdot \text{m}$  and a magnetization of 20 to 100 ( $\text{Am}^2/\text{kg}$ ) at  $1000/4\pi$  (kA/m).

40. The two-component developer according to claim 37, wherein the carrier is a magnetic substance dispersion coated carrier, which comprises a core in which a metal compound is dispersed in a binder resin, and a surface of the core is coated with a resin.

41. The two-component developer according to claim 40, wherein:

the metal compound comprises at least two kinds of metal compound particles;

a ratio of the metal compound to the binder resin is 80 to 99% by mass, one of the two kinds of the metal compound particles is a ferromagnetic body and the other is a non-magnetic metal compound having a resistance higher than the ferromagnetic substance; and

a ratio of the ferromagnetic substance to a total amount of the metal compound particles is 50 to 95% by mass.

42. A two-component developer according to claim 41, wherein the metal compound of the carrier comprises magnetite as the ferromagnetic substance and hematite as the non-magnetic metal compound.

43. A two-component developer according to claim 40, wherein the binder resin of the carrier is made of

a thermosetting resin and has a crosslinked structure.

44. A two-component developer according to claim 40, wherein the binder resin of the carrier comprises a phenolic resin.

45. A two-component developer according to claim 37, wherein

the toner comprises the toner according to any one of claims 14 to 36.

46. An image forming method using an image forming apparatus comprising: an image bearing member; a charging unit charging a surface of the image bearing member; an information-writing unit forming an electrostatic latent image on the image bearing member being charged; a developing unit visualizing the electrostatic latent image with a toner; and a transfer unit transferring a visualized toner image to a transfer material directly or through an intermediate transfer member, wherein:

the toner comprises at least a toner particle and an external additive, and the toner particle has a weight average particle diameter of 4 to 9  $\mu\text{m}$ ; and

the external additive contains at least a silica fine particle (A) which has been hydrophobic treated, and has a peak in a particle diameter range of 0.04  $\mu\text{m}$

or more and less than 1  $\mu\text{m}$  and a peak in the particle diameter range of 1  $\mu\text{m}$  or more and less than 100  $\mu\text{m}$  in a volume-basis particle diameter distribution measured by using a laser diffraction particle diameter distribution meter,

the silica fine particle (A) has a frequency ratio of 10 to 80% for the particles with a particle diameter in the range of 0.04  $\mu\text{m}$  or more and less than 1  $\mu\text{m}$  to a total of all the peaks, and has the frequency ratio of less than 16% for the particles with the particle diameter of 20  $\mu\text{m}$  or more and less than 2000  $\mu\text{m}$  to the total of all the peaks, respected to the volume-basis particle diameter distribution.

47. An image forming method according to claim 46, wherein the charging unit comprises a charging roller which has a surface hardness of 30 to 80 degrees on the basis of Asker C.

48. An image forming method according to claim 46, wherein the charging unit comprises a charging roller which has a surface hardness of 40 to 70 degrees on the basis of Asker C.

49. An image forming method according to claim 46, wherein the image forming method utilizes a tandem system.

50. An image forming method according to claim 46, wherein the image forming apparatus further comprises a cleaning blade to be brought into contact with the image bearing member.

51. An image forming method according to claim 46, wherein the developing unit adopts a cleaning-simultaneous-with developing system, which recovers a transfer residual toner while developing the electrostatic latent image.

52. An image forming method according to claim 46, wherein the toner comprises the toner according to any one of claims 14 to 36.